

DRAFT TOPEX Side B Sigma0 Calibration Table Adjustments: June 2004 Update

D. W. Hancock III and G. S. Hayne

NASA Goddard Space Flight Center

Observational Science Branch

Wallops Flight Facility

Wallops Island, VA 23337 USA

revised 11 June 2004

correspond with D.W. Hancock III, phone: 757-824-1238

fax:757-824-1036 email: David.W.Hancock@nasa.gov

Introduction

The TOPEX Altimeter Calibration Parameter Table, referred to as the Cal Table in the following, includes predicted updates for future cycles. At the Wallops Flight Facility of NASA's Goddard Space Flight Center we monitor trends in quantities related to the TOPEX altimeter's return power estimation and we propose, as appropriate, changes to the Cal Table. The Cal Table has been held at constant values since TOPEX cycle 363, and the Ku- and C-band sigma0 values have been remarkably stable for almost two years since that time (cycle 363 began on 22 July 2002). Now however there has been enough change that the Cal Table should be updated. The following sections summarize Cal Table history, describe the sigma0 trend fits that are the basis for a proposed new set of Cal Table values, and present the new values. It is proposed that the new Cal Table begin at cycle 432 (which started on 05 June 2004).

Review of Cal Table History

Before launch we had expected that the Calibration Mode 1 AGC would be the basis for Cal Table updates, but the Cal Mode AGC trend differed sufficiently from the over-ocean sigma0 cycle averages that we chose to base Side A Cal Table updates on the trend in the sigma0 cycle averages. Because the Cal Table corrections have already been applied to the sigma0 in the distributed GDR (Geophysical Data Record), it is important to remove these Cal Table corrections from the data before doing the trend assessment. All the sigma0 trends discussed here are after the Cal Table corrections have been removed. Basing the sigma0 correction on the trend of the uncorrected sigma0 itself is highly incestuous, and we tried only to make the corrections on the basis of relatively long-term trends. The TOPEX Side A history is discussed in a note "TOPEX Sigma0 Calibration Table History for All Side A Data", by G. S. Hayne and D. W. Hancock III, 27 July 1999, available at http://topex.wff.nasa.gov/docs/Sigma0Cal_A_All.pdf.

After the switch to Side B operation at the start of cycle 236, we observed that the Side B Cal Mode AGC trend did initially appear to follow the trend of the sigma0 cycle averages, but eventually the Cal AGC and the sigma0 trends diverged and we were again forced to use the long-term sigma0 trends for producing the Cal Table sigma0 corrections. The most recent Side B Cal Table change before now was described in "TOPEX Side B Sigma0 Calibration Table Adjustments: March 2002 Update", by G.S. Hayne and D.W. Hancock III, 08 March 2002, available at http://topex.wff.nasa.gov/docs/mar_02_update_sig0_cal_tbl.pdf.

Line Segment Fits to Side B Sigma0 Trends

There was a spacecraft safe hold for most of cycle 256, and the Ku-band Cal mode AGC and sigma0 cycle averages showed an apparent change after the safe hold. The C-band showed much less change, if any, after the safe hold. After cycle decided to assume a possible discontinuity in performance of both the Ku- and C-band systems at cycle 256, and to fit both the Ku- and C-band Side B sigma0 cycle averages (seasonally-corrected) from cycles 236 - 255 by single straight-line segment.

For the data from cycles 257 - 428, we arbitrarily decided to fit the sigma0 cycle averages by a function consisting of three connected straight-line segments. This fitting function will be continuous in value, but will have two discontinuities in slope, and we let the least-squares fitting process pick the time (or cycle) location of the discontinuities. An alternative to the three-line-segment fit might be to use a low order polynomial function, but this has the disadvantage of poor extrapolation outside the fitted region, and the new Cal Table values have to be reasonable for at two dozen cycles into the future.

The results of the sigma0 trend fitting are shown in Figure 1, in which both the sigma0 cycle averages and the trend fits have been plotted relative to their cycle 237 values; the shift to cycle 237 values is for convenience to allow both the Ku- and C-band data and fits to be plotted on a single vertical axis. Figure 2 shows the Ku-band fit residuals, and Figure 3 shows the C-band fit residuals.

Figure 4 shows the proposed new Cal Table values from the Ku-band fit together with the Cal Table values already used in GDR production. The fitted Ku-trend is shown by the solid black line in the figure, and the proposed new Ku-band Cal Table are derived from this trend by using the same (arbitrary) 0.03 dB quantization which has been used in all previous Cal Table updates. The new Cal Table values, from cycle 395

New Sigma0 Correction Values for Cal Table

Starting with the fitted sigma0 trends shown in Figure 1, the inverse of these trends will be used for the Cal Table updates. Figure 4 shows the Ku-band old and new Cal Table values. This figure may be slightly misleading in its plotting an “old” Cal Table value for each cycle; actually the Cal Table entries list only the changes in sigma0 calibration. One additional adjustment to the new Cal Table values is to impose a 0.03 dB quantization on the Cal Table updates. This is the same quantization that has been used in all of the TOPEX Cal Table entries to date, and the quantized new Ku-band Cal Table values are shown by the open triangles plotted in Figure 4. The new quantized Ku-band Cal Table values are listed in Table 1. Figure 5 shows the C-band old and new Cal Table values, and the new quantized C-band Cal Table values are also listed in Table 1.

Until the analysis reported here, the last “old” Cal Table change was at cycle 363, with that value being held for processing cycles 305 through 431. Table 1 provides new Cal Table values out through cycle 475, with the values for cycles greater than 428 having been obtained by simple extrapolation of the rightmost fitted straight-line segments in Figure 1.

We recommend using the new Cal Table values of this memo beginning with cycle 432.

Although Table 1 provides new quantized Cal Table values through cycle 475, it is possible that an additional Cal Table adjustment will have to be made before the time of cycle 475. We will continue our normal reassessment of the TOPEX sigma0 trends every three or four cycles, and propose future Cal Table changes as needed.

Table 1`. TOPEX New Sigma0 Cal Table Values			
Cycle	Ku-band, dB	C-band, dB	change?
432	0.30	0.88	yes
433	0.30	0.88	
434	0.30	0.88	
435	0.30	0.88	
436	0.30	0.88	
437	0.30	0.88	
438	0.30	0.88	
439	0.30	0.88	
440	0.30	0.88	
441	0.30	0.91	yes

Table 1`. TOPEX New Sigma0 Cal Table Values			
Cycle	Ku-band, dB	C-band, dB	change?
442	0.30	0.91	
443	0.30	0.91	
444	0.30	0.91	
445	0.30	0.91	
446	0.30	0.91	
447	0.30	0.91	
448	0.30	0.91	
449	0.30	0.91	
450	0.30	0.91	
451	0.30	0.91	
452	0.30	0.91	
453	0.33	0.91	yes
454	0.33	0.91	
455	0.33	0.91	
456	0.33	0.91	
457	0.33	0.91	
458	0.33	0.91	
459	0.33	0.94	yes
460	0.33	0.94	
461	0.33	0.94	
462	0.33	0.94	
463	0.33	0.94	
464	0.33	0.94	
465	0.33	0.94	
466	0.33	0.94	
467	0.33	0.94	
468	0.33	0.94	
469	0.33	0.94	
470	0.33	0.94	
471	0.33	0.94	
472	0.33	0.94	

Table 1`. TOPEX New Sigma0 Cal Table Values			
Cycle	Ku-band, dB	C-band, dB	change?
473	0.33	0.94	
474	0.33	0.94	
475	0.33	0.94	

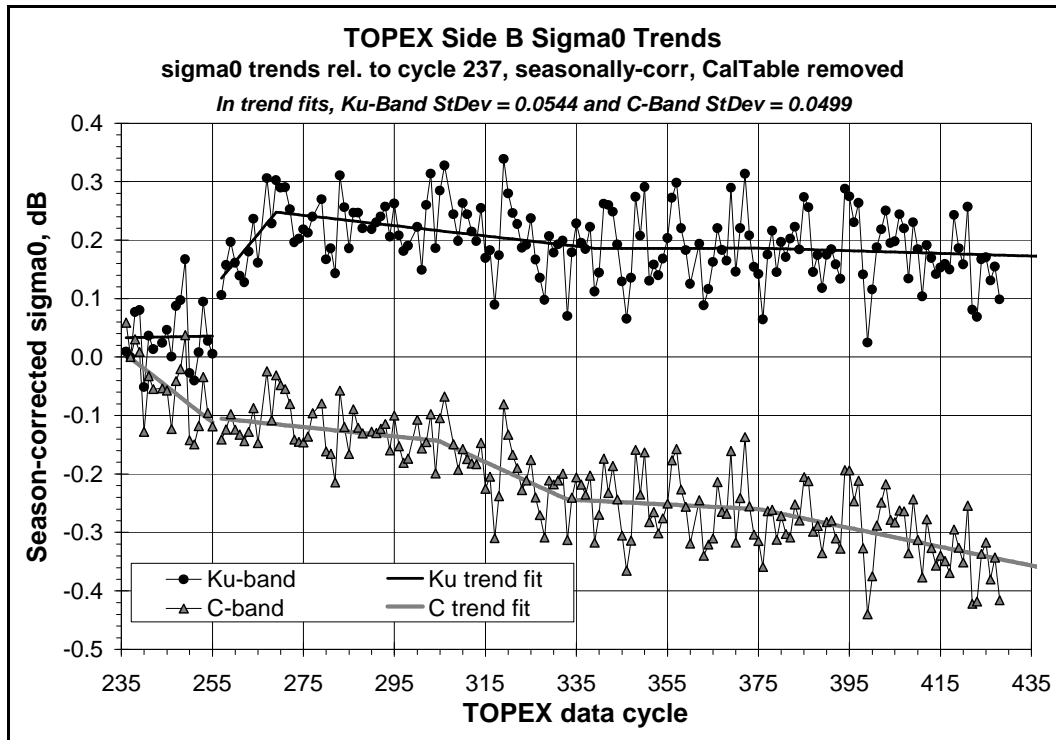


Figure 1

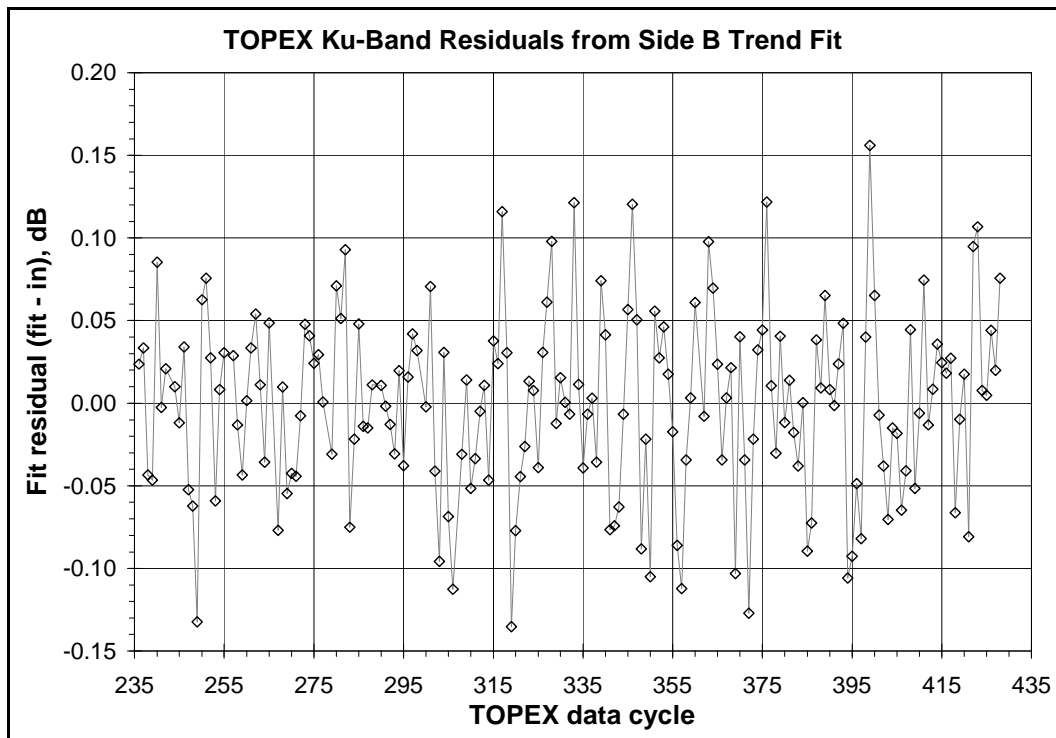


Figure 2

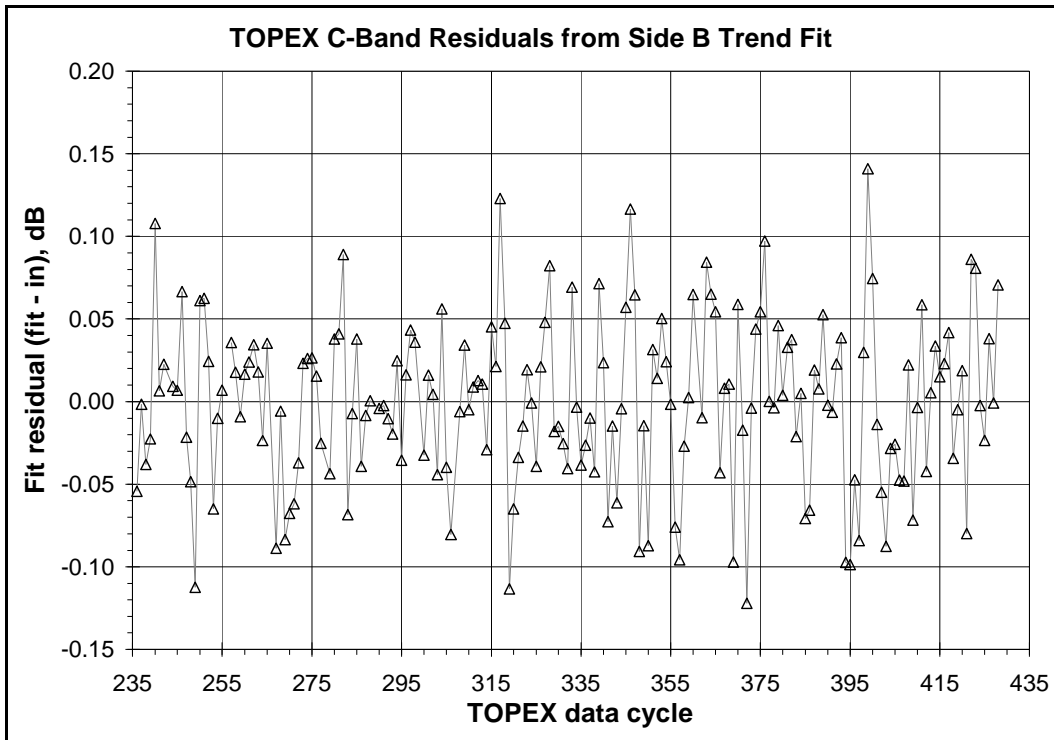


Figure 3

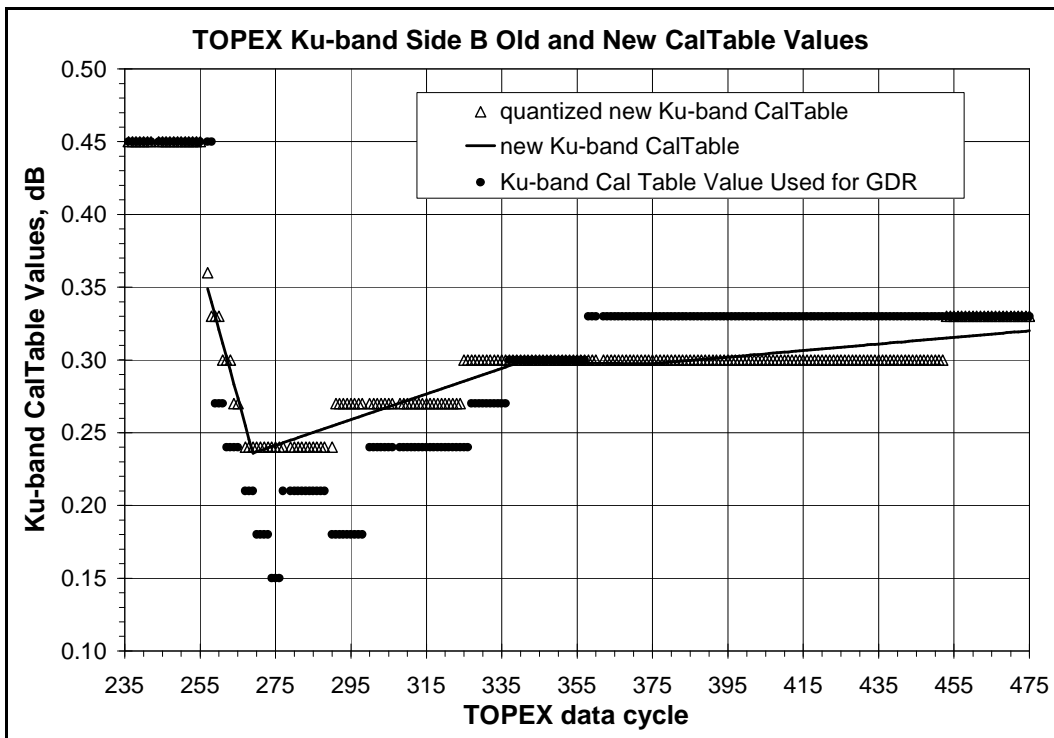


Figure 4

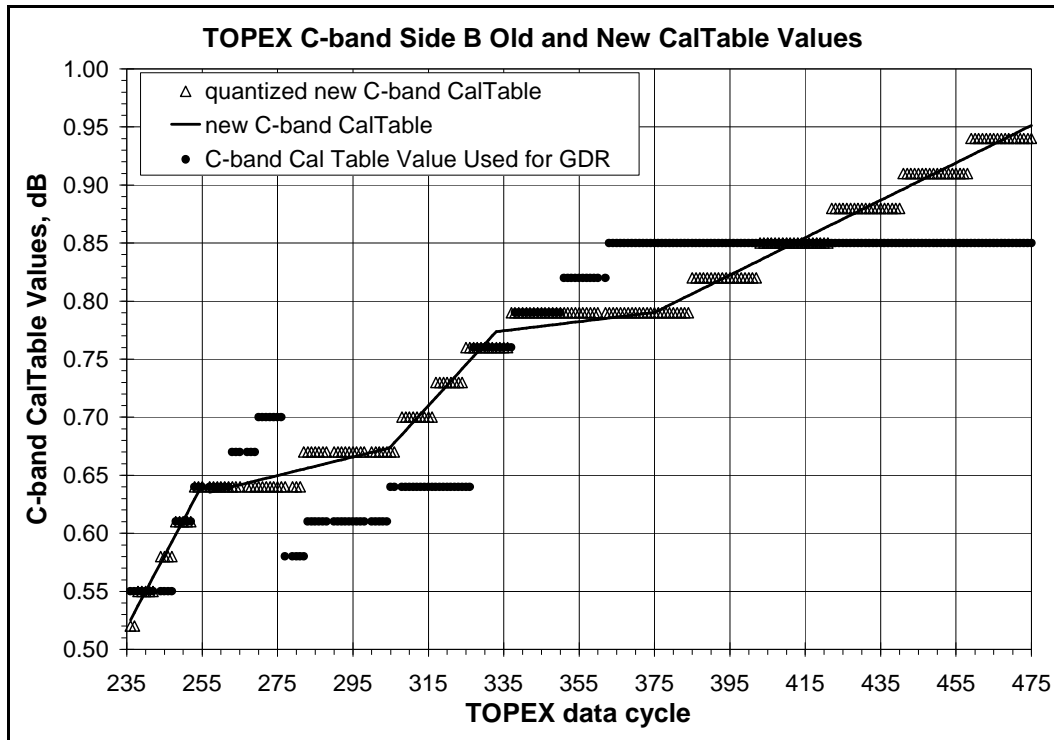


Figure 5